Enucleation of Giant Hemangiomas of the Liver

Technical and Pathologic Aspects of a Neglected Procedure

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Cavernous hemangiomas are the most common benign tumors of the liver. Giant cavernous hemangiomas, defined as those larger than 4 cm in diameter, can reach enormous proportions. Newer imaging modalities, although often demonstrating characteristic features that strongly suggest the diagnosis, should not be augmented by biopsy because of the risk of hemorrhage. Elective surgical resection may be indicated for symptomatic giant lesions and for those with an atypical appearance where the diagnosis is in doubt. Between October 1986 and May 1991, we treated 10 patients with giant hemangiomas by enucleation or enucleation plus resection. Median operative blood loss was 800 mL (range, 200 to 3000 mL). One patient required reoperation for control of postoperative hemorrhage. Detailed pathologic examination has demonstrated an interface between hemangiomas and the normal liver tissue that allows enucleation. Enucleation is an underused procedure that if carefully performed allows resection of giant hemangiomas with a reduced blood loss and the preservation of virtually all normal hepatic parenchyma.

WHETHER GIANT CAVERNOUS hemangioma of the liver should be treated conservatively or resected is controversial. Even for symptomatic giant hemangiomas, some authors have advocated long-term follow-up. One of the reasons given for this policy is that the morbidity and mortality rates associated with major liver resections have been suggested by some as prohibitive. The almost negligible mortality rate recently reported for elective resection in specialized centers[1-7] does not support this pessimistic view. Deaths that do occur for these lesions generally occur during the rare case of emergent treatment of spontaneous bleeding or rupture. In this situation, a rapid and safe approach is essential if massive blood loss is to be prevented. The extensive blood supply of these lesions nevertheless requires a meticulous and standardized surgical approach.

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The approach we have employed depends on prior control of the major extrahepatic feeding vessels, and dissection within the relatively less well perfused rim of compressed tissue through which the feeding vessels supply the lesion.

This paper describes a technique of enucleation that can be applied to both the elective and emergency management of giant cavernous hemangiomas, ensuring minimal blood loss and the preservation of virtually all normal hepatic parenchyma.

Patients and Methods

Between October 1986 and May 1991, 10 patients with a diagnosis of giant cavernous hemangioma were operated on (Table 1). There were nine women and one man, with a mean age of 49 years (range, 29 to 59). All had been referred complaining of abdominal symptoms of pain[6] or symptoms due to the size of the tumor[4] (vomiting, distension). Nine patients had right-sided lesions (two separate lesions in one patient), and one was on the left of the liver. Two patients had previous percutaneous biopsy. Before operation, all patients had a complete clinical and biochemical assessment. The tumor extent was examined by computed tomography (CT) and selective hepatic angiography. Anatomic details are shown in Table 1. Resected specimens varied in size from 5 × 7 cm to 25 × 20 × 15 cm. Ten patients were treated by enucleation, and in one patient this was combined with a formal right extended hepatectomy. In this patient, with a very large lesion extending to the falciform ligament, it was believed that the blood supply of segments II and III could only be preserved safely by a formal resection at that interface.

TABLE 1. *Demographic Data, Operative Findings, and Subsequent Pathologic Classification in 10 Patients With Enucleation of Giant Hemangiomata*

No.	Age	Sex	Segmental Involvement of the Liver (Couinaud 18)	Type of Operation	Operative Blood Loss (mL)	Tumor Dimension (cm)
1	56	F	VI	Enucleation	300	5 × 7
2	46	M	II/III	Enucleation	2000	12 × 24
3	46	F	IV	Enucleation + right lobectomy	2000	21 × 12
4	53	F	IV/V	Enucleation	800	9 × 9.5
5	59	F	IV/V/VIII	Enucleation of 2 tumors	200	8 × 6.5 5 × 4.5
6	59	F	IV/V	Enucleation	500	8 × 9
7	59	F	IV	Enucleation	400	12.5 × 8
8	47	F	IV/V/VI VII, VIII	Enucleation	3000	23 × 18
9	29	F	V/VI/VII/VIII	Enucleation	3000	25 × 20
10	40	F	IV/V/VI/VIII	Enucleation	1400*	15 × 20

* Only first operation.

Operative Technique

A bilateral subcostal incision was employed in all patients, and the liver was mobilized completely.[8] Inflow control is achieved by the use of Pringle maneuver. It was used employing a soft clamp across the portal pedicle below the hilus. Clamping was carried out in an intermittent fashion, the clamp being released at 15-minute intervals. Depending on the site and the arterial supply of the tumor identified before operation, the right or left hepatic artery is identified and traced back to the common hepatic artery. After the relevant hepatic artery had been ligated, there is a gradual reduction in the size and distension of the hemangioma, which may be augmented by gentle pressure. At this stage, it is important to alert the anesthetist to the imminent circulatory hypervolemia that may result during manipulation of the hemangioma deprived of its arterial blood supply. Adequate peripheral venous access is mandatory to permit rapid resuscitation if necessary.

Bleeding from the enucleation site can be controlled by prior complete extrahepatic vascular control. To achieve this control, it is important to dissect the hepatic artery to its bifurcation. Ligation of the right or left hepatic artery for a major lesion of the right or left liver is usually adequate. For lesions of the quadrate lobe, however, a more selective dissection controlling the relevant vessels within the umbilical fissure may be necessary. Continued bleeding at, or after, enucleation should lead to a further dissection to identify and ligate any further arterial supply to the hemangioma. In general, for left-sided lesions, the entire lesser omentum in the gastrohepatic ligament should be divided. A division of only a few millimeters of liver tissue at the periphery of the hemangioma is usually all of the parenchymal dissection required. At this point, a sheath of compressed liver tissue is encountered that usually clearly defines the border between the cavernous tissue and the normal liver parenchyma. The dissection is now possible by gliding the surgeon's finger along this sheath, and following the margin of the lesion and avoiding entry into either the liver parenchyma or into the tumor itself. As blood vessels or bile ducts are encountered, they are controlled by suture ligature and divided. Proceeding in this way, it is possible to shell out the hemangioma from the parenchyma without damage to major vessels or bile ducts. The resulting hepatic defect after enucleation can be treated in a variety of ways. Generally, the bleeding from the bed of the hemangioma is minimal and can be controlled by compression and the use of fibrin glue (Tissucol, Immuno AG, Zürich). The omentum may be mobilized and placed over the free surface. If significant bleeding persists, feeding vessels may have been missed. When all the veins have been controlled and diffuse bleeding from the tumor bed persists, a temporary (24 hour) packing of the resection site can be employed. If the resection area is large, a Silastic tube drain may be placed adjacent to the cavity for 24 to 48 hours.

Results

The tumor location, type of operative procedure, and blood loss are shown in Table 1. The median blood loss was 800 mL (range, 200 to 3000 mL). In the patient in whom enucleation and resection were combined, the blood loss was 3000 mL. There were no deaths, and there was one major complication. This patient, a 40-year-old woman, presented with a giant dependent tumor arising from segment IV. At operation, there was incomplete control of bleeding. Reoperation was required, and the liver was packed. The bleeding was demonstrated to be due to failure to control an accessory artery to the left liver.

Pathologic Classification

The histology of all the resected tumors was examined. Special attention was directed to the interface between the hemangioma and the hepatic parenchyma. Several zonal patterns could be discerned, but a major element consisted of a rather distinct fibrous capsule, which macroscopically corresponded to the plane of enucleation (Fig. 1).

Discussion

Cavernous hemangiomas of the liver occur in 0.4% to 7.3% of autopsy series and represent the most common benign tumor of the liver.[1,9-12] The surgical management of giant cavernous hemangioma was described as early as 1942 by Schumacker,[7] and recently there has been renewed interest with the advent of noninvasive imaging techniques.

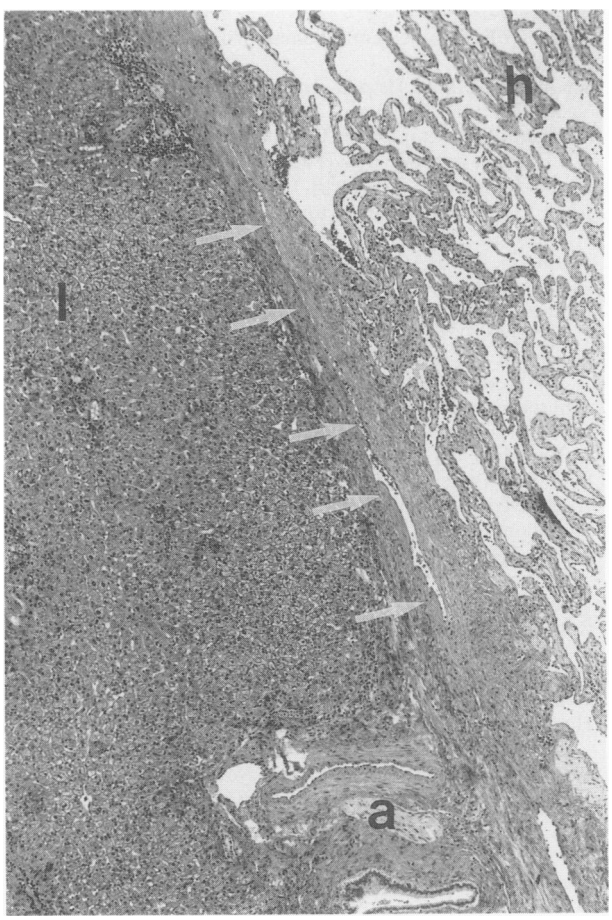

FIG. 1. Interface between the periphery of the hemangioma (h) and adjacent liver parenchyma (l) is characterized by a capsule-like fibrous lamella (arrows), thus producing a clear demarcation zone between the two components. Note that the fibrous capsule is in continuation with a large portal tract area (a). The enucleation procedure separates liver parenchyma from the hemangioma in the line of the fibrous lamella (H & E, ×40).

Diagnostic methods such as computed tomography, ultrasound, and magnetic resonance imaging often provide an early and reliable diagnosis. On computed tomography, the characteristic findings are hypodense areas that enhance considerably after the administration of intravenous contrast with late central filling.[7,13] Magnetic resonance imaging has recently been assessed by Stark et al.,[14] who report a 90% sensitivity and 92% specificity.[14] Selective arteriography often will give additional information by demonstration of the characteristic patchy pooling of contrast, and by defining the intrahepatic and extrahepatic vascular anatomy. Although these preoperative investigations may be convincing, they can not predict the natural history of the lesion with absolute certainty.

Giant hemangiomas are defined as those larger than 4 cm. It is our opinion that operative exploration with possible resection is the best course of action in fit patients with recurrent symptoms in whom the diagnosis is uncertain. Percutaneous biopsies should never be performed. There is a risk of provoking massive and uncontrollable hemorrhage,[2,3,15] and the results of fine needle aspiration cytology are unreliable, with a significant false-negative rate in large lesions that later may be proven to be malignant. Necrotic and fibrotic material make the needle biopsy difficult to interpret. In a series of 40 needle biopsies, there was one false-positive diagnosis of hemangioma that subsequently was proven to be a hepatocellular cancer.[4] Giant hemangiomas occur most frequently in women in the fourth and fifth decades and can reach enormous proportions. Resected tumors of several kilograms have been described that presumably weighed considerably more when engorged with blood. The origin of hemangiomas is debated. Some authors have suggested that they are benign congenital vascular neoplasms that grow slowly after birth; others believe that they are spontaneously occurring new neoplasms.[11,16] Recently, Conter and Longmire[17] reported four patients treated successfully with hepatic resection or radiation therapy who developed new symptomatic tumors after an average period of 14 years. All of these patients had been given chronic estrogen replacement therapy, and the author suggested that this may have played a role in the pathogenesis of these tumors.

The natural history of hepatic hemangiomas remains unclear. Spontaneous rupture of giant hemangioma is reported in the literature, but is rare, and the possibility is not an indication for hepatic resection. Consequently, the usual indication for resection of giant cavernous hepatic hemangioma remains significant abdominal pain or discomfort.[1-3,10,14] A representative series reported 13 resected and 36 observed giant hemangiomas.[15] The mean follow-up was 6.6 years, and there were no complications in the nonoperative group, with only four of the 36 tumors increasing in size.

A review of 166 liver tumors we have assessed over a 4-year period disclosed six cases that have been referred with a confident radiologic diagnosis of hemangioma. At operation, these six cases were found to be a hemangioendothelioma in one, a hemangiosarcoma in a second, and four cases of hepatocellular cancer or mixed hemangioma with hepatocellular cancer elements. Thus, the important problem may not be in the complications occurring in asymptomatic hemangiomas, but in the difficulty of obtaining an accurate diagnosis. Surgery is indicated when hemangiomas become symptomatic or when malignancy cannot be ruled out. If during operation doubt persists, then, after vascular control, biopsy and frozen section can be carried out before proceeding to enucleation of the tumor. We believe that resection is the preferred form of treatment of giant hemangiomas.

Most authors[1-3,5,10] report formal hepatic resection for large tumors and perform segmentectomy or enucleation only for smaller lesions. Schwartz[1] concludes that "most large tumors are best resected along anatomical planes i.e. a lobectomy or trisegmentectomy with inflow vascular occlusion." The enucleation technique we have employed allows very large hemangiomas to be resected with a limited disruption of the surrounding liver tissue. Although we have experience with ultrasonic dissection[18] and water-jet dissection[19] of hepatic tissue, we have not used these techniques in the treatment of hemangioma because of only minimal parenchymal dissection with our enucleation technique. The reason this is possible is demonstrated by the histology. The enucleation occurs along the relatively avascular capsular plane. The few blood vessels that do traverse the capsule are encountered and the amount of normal functioning parenchyma removed is minimal. Even when the size of the tumor means that most of the right or left lobe has been removed, the disturbance of liver function has been insignificant. Our median blood loss for enucleation for 11 lesions in 10 patients was 800 mL, and compares favorably with that reported by Schwartz (1750 mL)[1] and Starzl et al. (1680 mL).[2] In the two cases in which the intraoperative blood loss was highest (3000 mL), enucleations were for very large lesions, requiring the addition of a formal resection in one and dissection along a plane that crossed a fibrosed and clotted hemangioma in the second. In the patient who required reoperation for bleeding, the arterial blood supply was not completely controlled. A dissection of the left and right hepatic artery to the main hepatic artery is necessary to identify possible anomalies or additional branches of the main hepatic artery and prevent this serious complication. Specifically, for left-sided lesions, division of the lesser omentum in the gastrohepatic ligament is advisable.

The technique of enucleation here described allows safe removal of even very large lesions in most cases.

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